Renewable Energy & Energy Efficiency Plan.

Suffolk House
1-8 Whitfield Place
London
W1T 5JU

Prepared on behalf of
Mr L Kruszelnicki
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Job No: 26173 (02)
Date: 15 October 2013

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Issue Status

Date	Issue	Reason	By
09 September 2013	1	S106 Condition Confirmation	Francis Noon
15 October 2013	2	S106 Condition Confirmation	Francis Noon

Prepared By : Francis Noon

Digitally signed by John Milner

For and on behalf of Baily Garner LLP

For more info on digital signatures see http://www.bailygarner.co.uk/digitalsignatures/

15 October 2013 12:20:34

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1.0 Executive Summary

1.1 Allenbuild Ltd South East has instructed Baily Garner LLP to undertake an energy study for the redevelopment of Suffolk House on Whitfield Place, London W1.

1.2 The report sets out various calculated options showing which renewable technologies will achieve the agreed Section 106 agreement's requirements, dated 23rd December 2010, for a 10% reduction in CO_2 emissions, as set out in clauses 2.31 (a) to (f) inclusive. This states the requirement for 'demonstrating that the system will reduce the development's CO_2 emissions by at least 10% after energy efficiency measures have been installed', and to support achieving an EcoHomes 2006 'Excellent' rating.

1.3 The development is assessed under Building Regulations AD L1A (2010) and the study calculations were carried out using current NES SAP 9.90 2009 compliant software to estimate the development's total annual energy consumption and carbon emissions.

1.4 The purpose of this report is to summarise the findings and make recommendations on suitable low and zero carbon (LZC) technologies for the development to support the Section 106 Agreement.

1.5 To calculate the energy demand and to minimise the CO_2 emissions, the following Energy Hierarchy strategy steps were followed:

- Fabric first: Install improved fabric U values and air permeability.
- Services second: Install efficient boilers with effective controls.
- Renewables last: Install renewable technologies.

1.6 On the basis of assumptions made for the building fabric performance and building services efficiency, SAP calculations were carried out and the results demonstrate that it is technically feasible to meet the 10% reduction in CO_2 emissions when on-site renewable energy technologies are incorporated into the development. The strategy will also provide 10 credits under EcoHomes 2006.

1.7 The S106 document Clause 2.31(a) refers to Ove Arup & Partners' Sustainability and Energy Statement, entitled Suffolk House Refurbishment – updated September 2010. However, it is proposed that the solar thermal panels be substituted with PV panels. The reason is that solar thermal arrays heat water and off-sets carbon from the gas supply. PV arrays produce power that off-sets carbon emitted from mains electricity. The latter produces much more carbon per kWh annually than the former. Photovoltaic panels and equipment are also easier to install and need much less maintenance than solar thermal panels, as the former has no moving parts and do not suffer the same system efficiency losses as piped systems. In addition, the economic benefits to the landlord are also to be considered.

1.8 Therefore, at this stage, it is considered that, on balance, the more practical renewables option is the installation of PV arrays to meet the 10% CO_2 reduction requirement from regulated energy loads.

Developer, Assessor and Project Details

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2.0 Introduction

2.1 On behalf of Allenbuild Ltd South East, an energy study for the redevelopment of Suffolk House on Whitfield Place London is instructed.

2.2 The purpose of this report is to estimate the total annual energy consumption of the development using Building Regulations AD L compliant SAP 2009 software to provide recommendations on suitably feasible low and zero carbon (LZC) technologies for this development to achieve a 10% carbon reduction after energy efficiency measures have been implemented and achieve an EcoHomes 2006 'Excellent' rating.

2.3 The development consists of 13 residential units, comprising one 1bed, ten 2bed and two 5bed flats and maisonettes, all within a single block.

2.4 Figure 1 shows the development site plan.

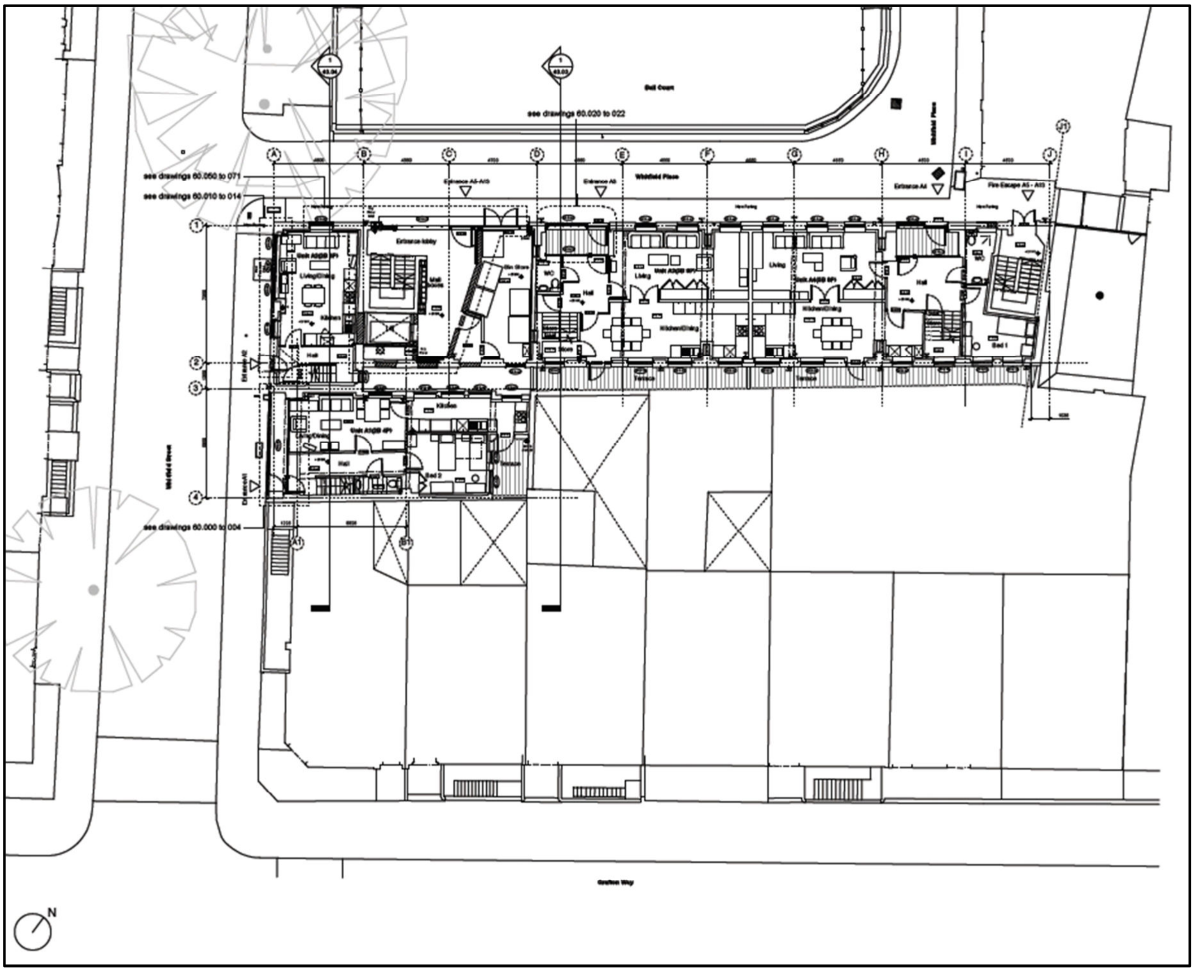


Figure 1 - Development Site Plan.

2.5 It is important to highlight that the calculations in this report are based upon the current construction drawing information and specifications and should there be any amendments to this information, further revisions to the calculations within this report will be required.

2.6 The actual outputs will be confirmed once the accredited On Construction Domestic Energy Assessor (OCDEA) has carried out full SAP calculations in accordance with Building Regulations AD L.

3.0 Planning and Legislation

National Policy

3.1 There are no specific planning conditions concerning energy conservation and carbon emissions in Camben Council's Grant of Planning approval, ref 2010/5185/P, that need to be met with respect to this development. However, the following text is shown for information purposes.

3.2 In recent years, there has been considerable progress and awareness in the role of minimising CO_2 emissions and consequent mitigation of Global Warming. As buildings contribute a large percentage of the total CO_2 emissions, it is logical that buildings should be designed and built to minimise their energy consumption and their CO_2 emissions. As a result of the above a combined effort by central government and local authorities is taking place.

3.3 In 2006 the Government has issued Part L of the Building Regulations, where the minimum energy efficiency requirements are set. The Climate Change Act (2008) sets a legally binding target for reducing UK carbon dioxide. The Draft Renewable Energy Strategy (2008) described the measures being considered to deliver the UK's target of generating 15% of its total energy from renewable sources by 2020, as its contribution to the EU's 20% target. The Draft Heat and Energy Saving Strategy (2009) aims to ensure that emissions from all existing buildings are approaching zero by 2050.

3.4 Both the EcoHomes (April2006) and Code for Sustainable Homes (November 2010) technical guidance documents contain credits that aim to reduce carbon emissions and atmospheric pollution by encouraging local energy generation from LZC sources to supply a significant proportion of the energy demand.

3.5 Planning and Compulsory Purchase Act 2004 places sustainable development at the heart of the planning system. In addition national planning policy requirements are given in the Government's Planning Policy Statement 22, where 'local authorities and developers should consider the opportunity for incorporating renewable energy projects in all new developments'.

Regional Policy

3.6 There are no planning conditions in the Camden Council's Grant of Planning approval, ref 2010/5185/P, that need to be met with respect to this development. However, the agreed Section 106 agreement's requirement for a 10% reduction in CO_2 emissions is set out in paragraph 2.31(f) of the S106 document. This states the requirement 'demonstrating that the system will reduce the development's CO_2 emissions by at least 10% after energy efficiency measures have been installed'.

4.0 Assessment Methodology

4.1 The Standard Assessment Procedure (SAP 2009) is the Government's recommended system for the home energy rating. It is a tool which enables people to calculate the energy demand and the CO_2 emissions of the assessed dwelling. A SAP assessment was carried out on each unit type to identify each dwelling's potential CO_2 emissions for each LZC technology. To calculate the percentage of reduction of LZC's to the total CO_2 emissions for each dwelling type, the emissions were compared with the emissions of the same units for a standard case SAP assessment based on a fixed service solution.

4.2 To calculate the percentage of reduction of LZC's to the total CO_2 emissions for each unit type, the baseline case emissions of the units with Energy Saving Measures, that pass current Building Regulations and the DER is equal or less than the TER, were compared with the emissions of the same units without renewables. To identify the energy performance of the scheme, the result of each unit type assessment is multiplied with the number of the units in each type.

4.3 The energy consumption of the proposed development has been estimated using NES 2010 SAP calculation software.

4.4 The associated carbon dioxide emissions were calculated using the following Part L1A 2010 fuel factors:

- Natural gas: 0.198kgCO2/kWh.
- Grid supplied electricity: 0.517kgCO2/kWh.

4.5 The strategy is outlined as to identify the Base dwelling values (typically values recommended by Building Regulation Documents) and then make the following improvements based on the following Energy Hierarchy:

- Be Lean: Use Energy Saving Measures (DER).
- Be Clean: Supply energy efficiently (CHP).
- Be Green: Install renewable technologies.

5.0 Be Lean

5.1 At the time of writing this report, the design was still in progress and details were not fully finalized. Therefore, for the purpose of energy calculation and to follow the steps of the energy hierarchy for this development to achieve a 10% carbon reduction after energy efficiency measures have been implemented, the SAP 2009 calculations have been carried out to show both the development's Dwelling Emission Rate (DER / Be Lean) with only energy efficiency measures and no renewables and the Dwelling Emission Rate (DER / Be Green) with both energy efficiency measures and renewables.

5.2 With reference to the S106 agreement clause 2.31(b), the 'Be Lean' standard for dwellings that includes energy saving measures is calculated in SAP software with fabric, services and ventilation values. These values are substantially better that the minimum values recommended by Building Regulations AD L1A 2010, all as indicated in table 1.

Fabric	Building Regulations 2010 U-value W/m^2K	Lean Building U-value W/m^2K
Existing external walls	0.30	**0.22**
New external walls	0.30	**0.18**
Separating walls	Not specified	**0.20**
Party Walls	0.00 - 0.50	**0.00**
Roofs	0.20	**0.12**
Windows/Doors	2.00	**1.40**
Floors	0.25	**0.15**

Table 1: 'Be Lean 'Building Fabric U Values.

5.3 With reference to the S106 agreement clauses 2.31(c), (e) and (f), the other recommended (assumed) for mechanical services included in the SAP calculations to establish the basic 'Be Lean' energy saving measures were as follows:

- Thermal Mass: Medium.
- Boiler: Communal gas-fired, 100% heat load, 97% efficiency.
- DHW: From main heating, via plate exchangers.
- Controls: Community charging link system, programmer, TRVs.
- NOx emissions: Not to exceed 40 mg/kWh.
- Ventilation: Decentralized whole house extraction.
- Air permeability: 5.0 m3/m2h@50Pa.
- Lighting: 100% low energy lighting.
- 'y' value: 0.15W/m^2k SAP default value.
- Pipework: All primary system insulated.
- LZC Technologies: As shown in this report.

5.4 The 'Be Lean' energy hierarchy values, shown in Table 1, represent both a typical, best economical construction practice applied to this development as well as significantly improved energy criteria that those minimum values recommended in Building Regulations AD L1A 2010.

5.5 SAP 2009 software was used to calculate the development's total annual carbon emissions by establishing the total TER and DER values with and without renewable technologies, based on all the dwellings within the development.

5.6 The results of the DER values for each dwelling, without (Be Lean) and with renewable technologies (Be Green), are list in Table 2.

Dwelling Emission Rates DER ($kgCO_2$/Annum)		
Plot No.	DER – 'Be Lean' (kgCO2/Annum)	DER – 'Be Green' ($kgCO_2$/Annum)
A1	22.07	19.43
A2	21.78	20.40
A3	13.31	11.90
A4	16.83	14.83
A5	19.62	18.30
A6	17.33	16.17
A7	15.76	14.78
A8	21.63	19.17
A9	18.12	15.29
A10	16.89	14.49
A11	16.86	14.49
A12	16.86	14.49
A13	19.35	16.32

Table 2: DER Emission Results.

Dwelling Types	Average Total CO_2 Emissions
Total Floor Area (m^2)	1230.17
Average DER with energy efficient measures No renewables.	17.71
Average DER with energy efficient measures With renewables.	15.68
Compliance Percentage Improvement	**11.6%**

Table 3: Results of Average CO_2 Emissions.

5.7 Table 3 indicates the overall average percentage carbon reduction between the development with the energy efficient measures installed and the same development after renewable technologies are fitted. The required amount of renewable technologies was calculated to make up the percentage emissions needed to achieve the Section 106 requirements for 10% carbon reduction. Table 3 confirms that the S106 requirement is achieved. The SAP 2009 block compliance reports are appended to this report.

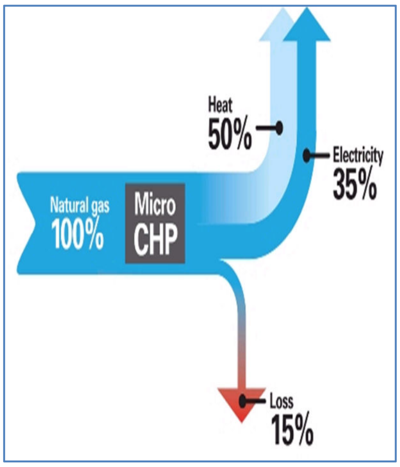
6.0 Be Clean

6.1 To complete the second step of the energy hierarchy, further analysis was carried out on the 'Lean' dwellings to identify the appropriate Low Zero Carbon Technologies. These are;

- Combined Heat & Power (CHP - Gas-fired).
- District and Community Heating.

6.2 The following paragraphs provide further detailed following technologies are not considered for further evaluation for this development:

Combined Heat and Power



6.3 CHP is viable for developments with a significant summer time hot water demand such as very large residential developments or hospital sites.

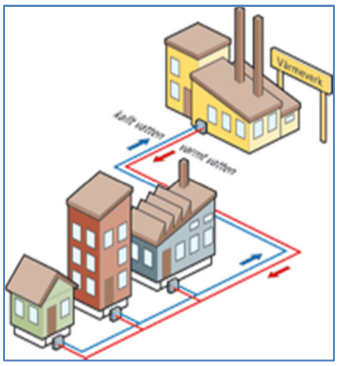
6.4 To maximise the use of a CHP system, it is essential to recover as much heat as possible from the machine so that the heat feeds into the heating system or absorption chillers, if any. CHP plants provide hot water when generating electricity and, to provide viability for the CHP, the plant should be run for as long as possible. The installation of a CHP system therefore requires a constant demand for hot water to be available. This is difficult to achieve in summer when no space heating is needed, only reduced demands for DHW heating.

6.5 The development will also require a central plant room that is large enough to house the CHP unit, auxiliary heating, buffer vessels and associated plant work. The necessary size of the plant room will be dependent on the CHP system, the size of the auxiliary heating system, and the volume of the water stored in calorifiers and/or buffer tanks.

6.6 CHP systems need greater levels of maintenance than standard gas boilers, requiring specialist installation and maintenance contractors. Regular servicing will include change of engine oil, spark plugs and air and oil filters. Full engine overhaul or replacement will be needed every 5–10 year intervals. Therefore, maintenance contracts can be established with manufacturers that include for remote monitoring and automatic call-out in case of operational failure.

6.7 However, the CHP option is not considered suitable for this size of residential development, due to the lack of space and DHW demand.

District & Community Heating



6.8 District heating is used for distributing heat generated in a centralized location. Usually district heating is more energy efficient, due to the concurrent production of both heat and electricity in combined heat and power (CHP) generation plants.

6.9 With reference to the London Heat maps and due to the site's location and size, this option is not considered feasible as no district heating system is currently available within close proximity of the site.

6.10 However, with reference to the Clause 2.31(d) of the S106 document, the scheme has sufficient space at basement level where the proposed high-efficiency communal gas-fired heating plant is to be installed. Provision will also be made for the installation of additional pipework connections between the plant-room and the site boundary to allow future connections to any proposed district power and heating networks into the development.

7.0 Be Green

7.1 To complete the third step **(Be Green)** of the energy hierarchy, further analysis was carried out on the 'Be Lean' Building to identify the appropriate Low Zero Carbon Technologies for this development. These technologies include;

- Solar thermal panels.
- Photovoltaic panels.
- Biomass.
- Wind turbine.
- Ground Source Heat pumps.
- ASHP.

Wind Turbines

7.2 Wind turbines can produce electricity without carbon dioxide emissions ranging from watts to megawatt outputs. Wind turbines harness the power in the wind, converting it into electrical energy for use within the development and/or can be exported to the grid.

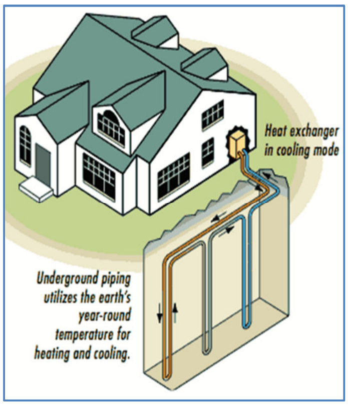
7.3 The wind speeds are shown to fluctuate within an inadequate range and as this development site is located in a medium density urban area, it is anticipated that wind turbines would also present difficulties in achieving planning permission due to the noise, visual impact and mechanical vibration of the turbines. This technology has not been investigated further.

7.4 The main factor affecting the output of wind turbines is the average wind speed. A small difference in wind speed will make a large difference to output. An efficient wind turbine strategy requires a minimum wind speed of 5 m/s.

7.5 The Department of Energy and Climate Change (http://www.decc.gov.uk/) provides national data relating to the UK wind speed. The average wind speed around this development site (OS map reference TQ292821) is reported to fluctuate between 4.8m/s to 5.0m/s at 10 metres above ground level.

7.6 The wind speeds were shown not to fluctuate within adequate ranges. Furthermore, the development is located in a populated urban area and it is anticipated that installing wind turbines would present difficulties in achieving planning permission due to the noise, visual impact and the mechanical vibration of the turbines on structure. On that basis, this technology is not investigated any further.

Ground Source Heat Pumps



7.7 Ground source heat pumps use pipes which are buried in the external ground to extract heat from the ground. This heat can then be used to heat radiators, under floor or warm air heating systems and hot water in the home.

7.8 A ground source heat pump circulates a mixture of water and antifreeze around a loop of pipe - called a ground loop - which is buried in your garden. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump.

7.9 Due to the size of the site this technology has not been investigated, as there would be difficulty in respect to drilling bore holes or laying trench based pipe loops due to the possible presence of existing sewage and telecom networks, supply cables and water and gas pipes.

Air Source Heat Pumps

7.10 Air Source Heat Pumps (ASHP) extracts heat from the outside air using an external condenser unit and a refrigeration system. This system is capable of providing 100% of heating and hot water demand and may also be integrated with solar panels to provide hot water when the air source heat pump is considered provide space heating only.

7.11 It is important to highlight that this system would require a significant number of external condenser units to be located externally on site and typically due to associated noise implications, this system requires acoustic screening.

7.12 As this is an urban residential area, the acoustic issues and visual impact of external condensers do not make this an attractive solution for reducing the carbon emissions for this development. In addition, this technology relies on expensive mains-fed electricity to power the system resulting in high electricity bills for the occupants and some ASHP units have had poor co-efficiencies of performance. Accordingly, this technology is not considered a very viable option for this site for these reasons.

Biomass Boilers

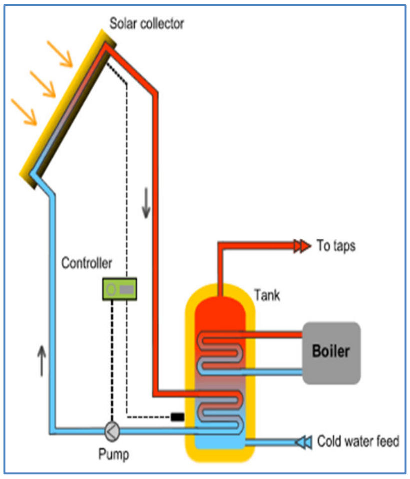
7.13 An efficient biomass heating strategy requires both efficient biomass boilers and large central plant room containing the biomass boilers with gas back up boilers.

7.14 One of the issues with biomass boilers is the supply of the fuel. Currently, within the UK where there is an abundant supply of wood chip batches that can be used for fuel. However, this type of fuel leads to greater inefficiencies compared to other types of biomass fuel such as wood pellets that are currently limited in supply, although suppliers within the UK are increasing.

7.15 Wood pellets are more controllable in terms of their moisture content and heat calorific value whereas the heat calorific value of the wood chips batches may vary as the moisture content varies within natural resources and subsequently it can cause issues for the heat demand, maintenance and servicing of boilers. In addition to this issue, the management of fuel deliveries, traffic routes, and highway design is problematic for developments in urban locations.

7.16 Biomass has other mitigating factors that can go against the decision to use these boilers versus other heating systems. These include transport carbon emissions, boiler and fuel storage space, boiler maintenance, fuel delivery frequency in urban or suburban areas, fuel source availability and reliability and high NOx emissions compared to natural gas. In respect to these matters and more importantly inadequacy of available on site space for the biomass fuel storage, this technology is not recommended.

Solar Panels



7.17 Typically solar thermal hot water systems are used to provide between 40%-60% of the total hot water demand within low density domestic housing where each dwelling is individually served. Whilst this is the case in this development, the size of solar thermal panels considered as being able to reduce sufficient carbon would be much greater that a PV array.

7.18 Solar Thermal panels substitute gas consumption for heating water. As gas produces approximately 2.5 times less carbon than electricity, the solar thermal option has been substituted in favour of PV panels for this reason.

Photovoltaic Panels

7.19 Photovoltaic panels are a semi-conductor based technology that converts the sunlight energy into electricity. When sunlight strikes the surface of a PV cell, this electrical field provides momentum and direction to light-stimulated electrons, resulting in a flow of current when the solar cell is connected to an electrical load. The PV systems should be un-shaded for the maximum output. It is important to highlight that even a small shading patch on the panel, can significantly reduce the performance. The generated electricity can be used both in the development and exported to the grid for benefiting from feed-in tariffs when excess electricity is generated.

7.20 Installing approximately 5.76kWp (43-49m^2) of photovoltaic panels will reduce the site carbon dioxide emission by 11.6% (See Table 3). This assumes that all PV arrays will be installed proportionally over the development on southerly facing roofs with 30° pitches and with over-shading less than 20%. An initial assessment was carried out on the roof space available where the calculated PV panel array can be installed.

7.21 With reference to clause 2.31(e) of the S106 document, the existing flat roof area is suitable to carry the amount of PV panels to provide the calculated output although this can only be achieved by ensuring that a very efficient PV array system is installed. over-shading of the proposed roof area where the PV array is to be installed has been assessed by a specialist PV installer and no issues have been identified. A proposed layout sketch is appended to this report.

7.22 Based on information available at the time of writing this report, initial investigation indicates that installing a photovoltaic panel array of approximately 5.76kWp could provide first year returns of about £1,040.00, based on 4.64p/kWh export tariffs and 13.50p/kWh feed-in tariffs, representing a payback period of about 6.17 years. Over a 20 year period, this represents an overall income of about £28,500.00 at 19.90% per annum (8.03% AER).

7.23 However, it should be noted that these figures are subject to varying market conditions and it is recommended that this be reviewed at detail design stage. Furthermore, the cost of a 5.76kWp PV array can vary between £10,300.00 and £15,300.00.

7.24 The installation of photovoltaic panels on their own is considered feasible for this development to meet the S106 requirements for 10% carbon reduction.

8.0 Conclusion

8.1 As set out in the Section 106 Agreement, the requirement to achieve the 10% reduction in CO_2 emissions resulting from the installation of renewables after the energy efficiency measures are installed is achieved by the installation of a photovoltaic array. Refer to appendices 1 and 2 that confirm the DER carbon outputs from the SAP calculations.

8.2 At this stage, it is considered that, the most practical renewables option would be the installation of PV arrays only to meet the Section 106 Agreement 10% requirement in carbon emissions. Photovoltaic panels and equipment are easier to install and need relatively less maintenance than solar thermal panels, as the former have no moving parts. In addition, there are also the economic benefits to the landlord and the freeholders to be considered.

8.3 The average Dwelling Emission rate for the whole development, indicated in Table 3, will also provide 10 credits under the EcoHomes 2006 environmental assessment methodology.

8.4 Based on information available at the time of writing this report, initial investigation indicates that installing a photovoltaic panel array of approximately 5.76kWp could provide first year returns of about £1,040.00, based on 4.64p/kWh export tariffs and 13.50p/kWh feed-in tariffs, representing a payback period of about 6.17 years. Over a 20 year period, this represents an overall income of about £28,500.00 at 19.90% per annum (8.03% AER).

8.5 However, it should be noted that these figures are subject to varying market conditions and it is recommended that this be reviewed at detail design stage. Furthermore, the cost of a 5.76kWp PV array can vary between £10,300.00 and £15,300.00.

8.6 The figures indicated in this report are indicative SAP 'design-stage draft' figures to inform the energy use, carbon emissions and design of the development. The actual outputs will be confirmed once a full set of design stage SAP calculations are completed.

Appendices 1 and 2.

Appendix 1: Dwelling Emission Rates Table (With energy efficiency measures and no LZC technologies).

Appendix 2: Dwelling Emission Rates Table (With energy efficiency measures and LZC technologies installed).

Appendix 3: Proposed Photovoltaic Panel Layout.

User Details

Assessor Name:
Software Name: Stroma FSAP
Stroma Number:
Software Version: Version: 1.5.0.54

Calculation Details

Dwelling	DER	TER	TFA
Plot A1	22.07	21.58	90.23
Plot A2	21.78	22.67	64.3
Plot A3	13.31	13.23	174.64
Plot A4	16.83	16.48	174.55
Plot A5	19.62	20.33	96.45
Plot A6	17.33	18.03	58.6
Plot A7	15.76	16.49	59.92
Plot A8	21.63	21.3	64.6
Plot A9	18.12	16.99	92.46
Plot A10	16.86	16.1	87.03
Plot A11	16.86	16.1	87.03
Plot A12	16.86	16.1	87.03
Plot A13	19.35	18.14	93.33

Calculation Summary

Total Floor Area	1230.17
Average TER	17.43
Average DER	17.71
Compliance	Fail
% Improvement	N/A

Dwelling Emission Rates – 'Be Lean' Development.

User Details

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP	**Software Version:**	Version: 1.5.0.54

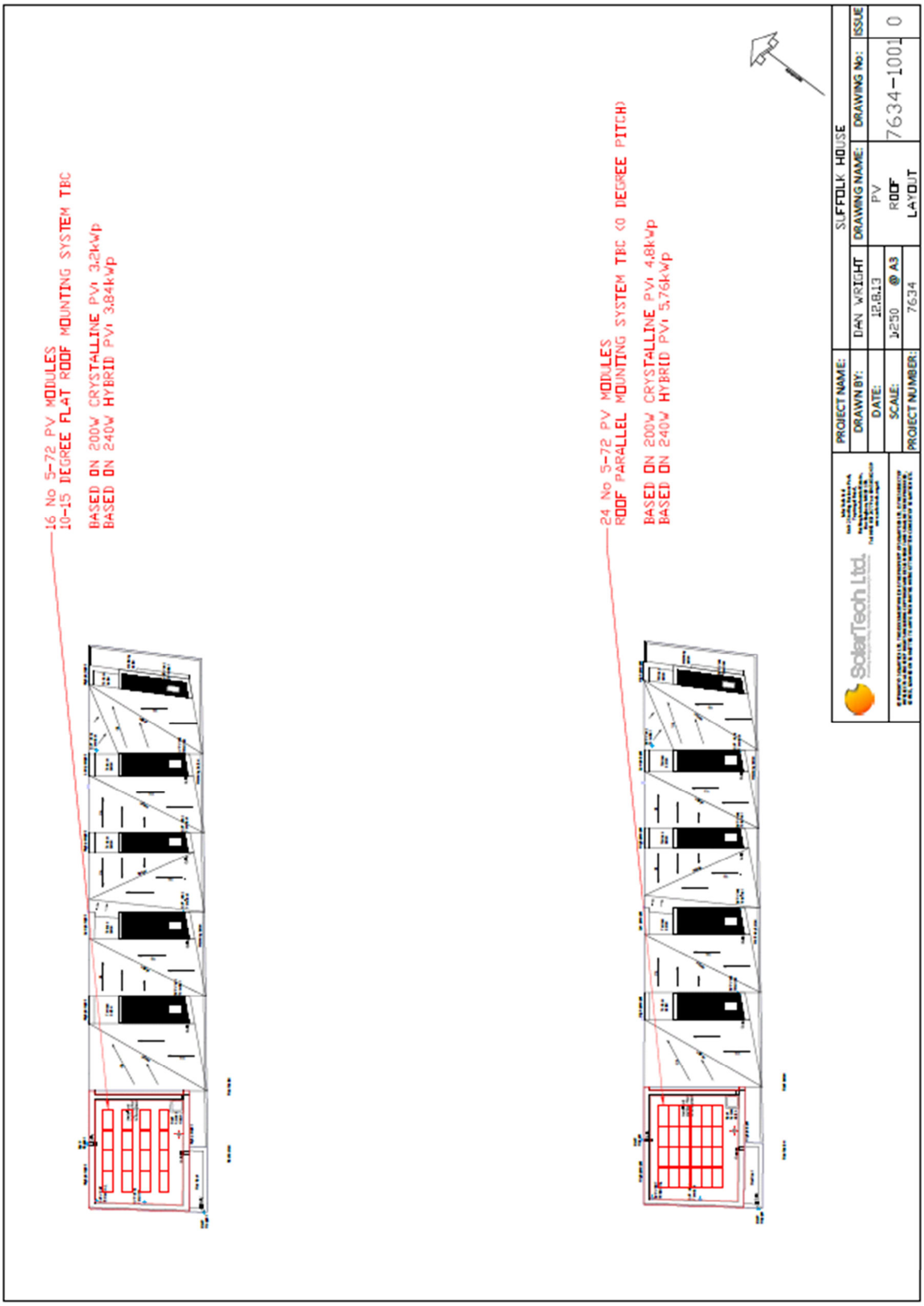
Calculation Details

Dwelling	DER	TER	TFA
Plot A1	19.43	21.58	90.23
Plot A2	20.4	22.67	64.3
Plot A3	11.9	13.23	174.64
Plot A4	14.83	16.48	174.55
Plot A5	18.3	20.33	96.45
Plot A6	16.17	18.03	58.6
Plot A7	14.78	16.49	59.92
Plot A8	19.17	21.3	64.6
Plot A9	15.29	16.99	92.46
Plot A10	14.49	16.1	87.03
Plot A11	14.49	16.1	87.03
Plot A12	14.49	16.1	87.03
Plot A13	16.32	18.14	93.33

Calculation Summary

Total Floor Area	1230.17
Average TER	17.43
Average DER	15.68
Compliance % Improvement	Pass 10.04

Dwelling Emission Rates – 'Be Green' Development.



Proposed Photovoltaic Array Layout (5.76kWp Output).